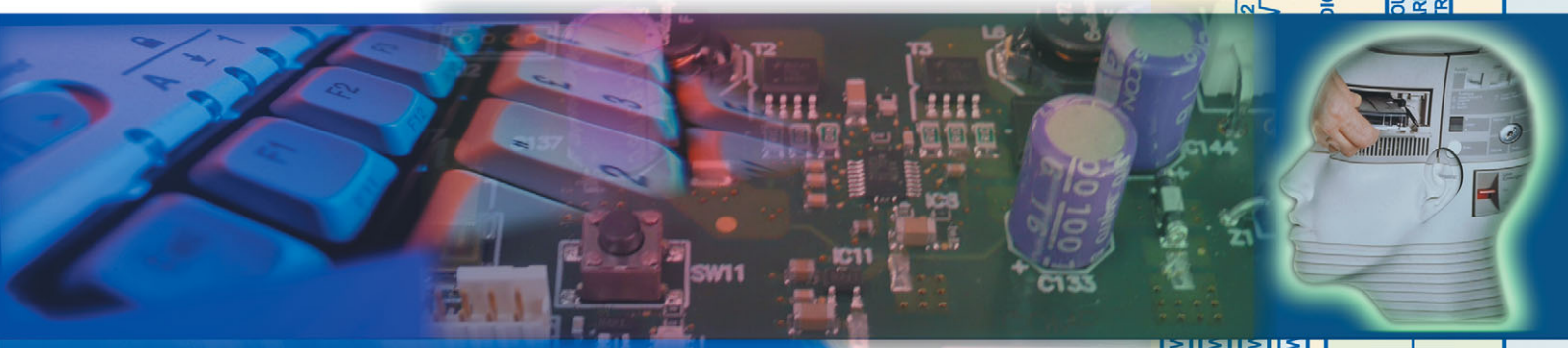
PROMAX

Electronic Training Equipment



Technology

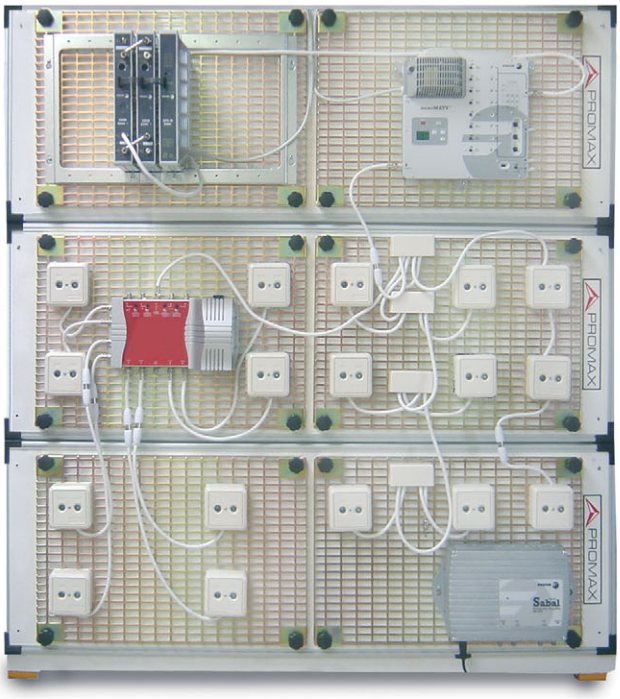
Consumer

Industrial

www.promaxelectronics.com

For two decades now, **PROMAX ELECTRONICA** has been designing education related instruments. Over the last few years, we have assigned a laboratory specifically for designing a range of latest-generation educational instruments to help train future professionals in the emerging technologies field (fibre optics, digital television, MPEG-2…) and other evolving technologies (telephony, digital electronics, consumer electronics…).

Below we present a brief list of our Educational range products.



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Programmable Logic Devices Training System **TM-530**
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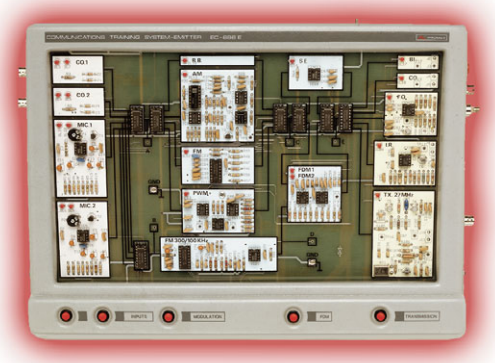
Microcontroller Training System **TM-311**
Basic PICs Trainer **IC-003**
Advanced PICs Trainer **IC-004**
Electrical Supply Installation Training Boards

Technology

Analogue Communications Training System

The Analogue Communications training system has several types of emitters, transmission channels, receivers, modulators and demodulators, in order to shape a transmission system easily. For instance, it permits to compare the advantages of several transmission systems to others, including those fibre-optics based, or to analyse interference phenomena.

Ease of use and the capability to measure the electrical signals throughout the equipment has been taken into account by means of a series of test points. To this end, circuitry is located into a desk-like cabinet, with a transparent fold-down cover for a complete access. The equipment is composed of one Emitter set and one Receiver set, to be linked during training, by the selected transmission method.



EMITTER MODULE EC-696/E

The **EC-696/E** emitting system is provided with several inputs where generators or microphones can be connected. A set of sequential controls allows the equipment to be configured quickly, by selecting the input, modulation (AM, FM, PWM) or transmission modes through five different channels: twin cable, coaxial, fibre-optic, infrared or radio. This equipment allows to transmit two different channels independently by means of frequency division multiplexing (FDM).

RECEIVER MODULE EC-696/R

Signals processed by the **EC-696/E** can be received and demodulated by the **EC-696/R**. This system is configured by four pushbuttons and a logic control, the same way as in the emitter. The demodulated and separate signals received can be displayed on the screen of an oscilloscope or monitored by means of earphones.

EMITER MODULE

Signal inputs

CO1 and CO2	Input from a generator
Maximum level	± 3 V
Bandwidth	DC to 20 kHz
Input impedance	≥ 20 kΩ (1 kHz)
MIC1 and MIC2	Microphone inputs (mono)
Sensitivity	6 mVpp, Adjustable
Input impedance	≥ 20 kΩ (1 kHz)

Modulators

AM Modulator	Voltage-controlled gain amplifier
Carrier frequency	100 kHz
Modulation index	0 to 100%
Bandwidth	DC to 20 kHz
FM Modulator	Voltage-controlled oscillator
Carrier frequency	100 kHz
Frequency deviation	± 50 kHz
Bandwidth	DC to 20 kHz
Pulse Modulator (PWM)	
Carrier frequency	100 kHz
Duty cycle	40 to 70%
Bandwidth	DC to 20 kHz
FDM/FM Modulator	Voltage-controlled oscillator
Carrier frequency	300 kHz or 100 kHz, selectable
Channel bandwidth	DC to 20 kHz

Emitters

Bifilar cable transmitter	Output through operational amplifier
Maximum level	± 3 V
Coaxial cable transmitter	Output through operational amplifier
Maximum level	± 3 V
Fibre optic transmitter	
Emission	By LED Photodetector
Emitting band	650 nm (red colour)
Infrared ray transmitter	
Emission	By LED Photodetector
Emitting band	950 nm
27 MHz Emitter	
Output level	0 dBm
Modulation index	50 %
Antenna	1.5 m cable Monopole

Analogue Communications Training System

RECEIVER MODULE

Receivers

Bifilar cable receiver	Direct, without processing
Coaxial cable receiver	Direct, without processing
Fibre optics receiver	
Type	(PIN) type Photodiode
Receiving band	400 to 1100 nm (90% efficiency)
Infrared receiver	
Type	PIN type photodiode
Receiving band	800-1000 nm (50% efficiency)
Radio receiver	Peak detector
Receiving band	27 MHz
Antenna	1.5 m Cable

Demodulator specifications

AM Demodulator	Fast detector
Bandwidth	DC to 20 kHz (bifilar and coaxial) 300 Hz to 20 kHz (fibre, infrared and radio)
FM Demodulator	DPLL type
Carrier frequency	100 kHz
Bandwidth	DC to 20 kHz (bifilar and coaxial)
Pulse demodulator (PWM)	Integrator type
Carrier frequency	100 kHz
Bandwidth	DC to 20 kHz (bifilar and coaxial) 300 Hz to 20 kHz (fibre, infrared and radio)
FDM/FM Demodulator	DPLL type
Carrier frequency	300 or 100 kHz selectable
Multiplex bandwidth	DC to 20 kHz (bifilar and coaxial) 300 Hz to 20 kHz (fibre, infrared and radio)

Output specifications

Earphone output	
Earphone output	AB Class
Volume control	Independent for left and right channels
Output power	200 mW over 32 Ω (3 Vpp in C)
Oscilloscope S1 and S2 outputs	
Output level	≥ 400 m Vpp (3 Vpp in A)

ACCESSORIES AND DOCUMENTS INCLUDED

* User's Manual.
* Practice Manual.
* Theory Manual.
* Dynamic microphones.
* Headphones.
* Antenna cables for radio transmission/reception.
* Fiber optics cables (PMMA) with FSMA connectors.
* Two wires cable.
* Coaxial cable.
* Coil.
* Metallic cylinder.

Recommended equipment:

Digital Oscilloscopes	Series OD-4xx, OD-57x, OD-59x
Signal generators	GF-230, GF-232, GF-941

Technology

Digital Communications Training System

*The **EC-796** is an ideal equipment for teaching digital transmission systems.*

It allows to cover the theory and practice of the different stages of a transmission system with ease: sampling, quantification, modulation, simulation of channel and reception; essential to lay the foundations for the modern telecommunication digital network and to understand more complex modulations , such multicarrier modulations which are the basis of Digital Video Broadcasting (DVB-T), ADSL, WiFi...

The **emitter** and **receiver** modules have a number of test points prepared for the monitoring of the signals. The **EC-796** allows the development of experiments at five levels:

- Analysis of the sampling and quantification of analogue signals, with acoustic and visual experimentation of the effect of the sampling frequency (aliasing) and of the number of bits used in the generation of the PCM signal.
- Study of digital modulations on continuous wave in amplitude, frequency and phase.
- Experimentation of the characteristics of circuit alternatives in the emission and reception modules.
- Analysis of the effect of disturbance in the channel (interference, noise, bandwidth and attenuation) on the different modulations.
- Experimentation on different means of transmission: coaxial cable, two-wire, infrared, radio and optical fibre.

The **EC-796** is presented in stackable desks, very easy to set up, designed both for graphic demonstrations of the theory explained in class, and for the student to carry out very attractive practices with basic instrumentation.

SIGNAL INLETS AND OUTLETS

- Inlets for Function Generator, TTL signals and microphone (monophonic microphone).
- Outlet for headphone and connectors for oscilloscope.

PCM SIGNAL, BASE BAND

Sampling and quantification:
- Clock: 1.333 MHz.
- T bit: 12 µs.
- 11 bits frame: 1 start, 8 data, 1 stop and 1 parity.
- Antialiasing filter; BW_{3dB}: 280-3400 Hz.
- Compander and expander for microphone.

MODULATORS

ASK (OOK)
- Modulator bandwidth: DC - 60 kHz

FSK
- Modulator bandwidth:
  DC - 60 kHz (DFD reception).
  DC - 200 kHz (FSK reception).

BPSK and DBPSK
- Modulator bandwidth: DC - 45 kHz.

QPSK and DQPSK
- Modulator bandwidth: DC - 45 kHz.

QAM
- 8 levels.
- Bandwidth: DC - 45 kHz.

DEMODULATORS

ASK (OOK)
- Types: band-pass filter, envelope detector, comparison circuit.

FSK
- Dual band pass filters, detectors and comparison circuit.
- PLL direct detector.

BPSK
- Phase ambiguity detector, automatically or manually.

DBPSK
QPSK
- Phase ambiguity detector, automatically or manually.

DQPSK
QAM
- Phase ambiguity detector, automatically or manually.

Digital Communications Training System

EMITTER CHARACTERISTICS

Twin Cable Emitter:
Output level (measured at connector):
- Receiver not connected: 0 to ±4 V (according to modulation).
- Receiver connected: 0 to ±3 V (according to modulation).

Connector: banana female adapter.

Coaxial Cable Emitter:
Output level (measured at connector):
- Receiver not connected: 0 to ±4 V (according to modulation).
- Receiver connected: 0 to ±3 V (according to modulation).

Connector: BNC female adapter.

Fibre Optic Emitter:
- Emission by LED.
- Emission wave-length: 850 nm (red).
- Connector: FSMA.

Infrared Emitter:
- Emission by LED.
- Emission wave-length: 950 nm.

27 MHz Emitter:
- Output level at 50 Ω: 10 dBm.
- Antenna: Monopole. 5 mm cable and 150 cm length.
- Connector: BNC female.
- Carrier frequency: 27 MHz (crystal).
- Modulation on AM: Modulation index of 10 to 40%, according to selected modulator signal.

RECEIVER CHARACTERISTICS

Twin-Line Cable Receiver:
- Type: Direct.
- Connector: Banana adapter.

Coaxial Cable Receiver:
- Type: Direct.
- Connector: BNC adapter.

Fibre Optic Receiver:
- Type: Photo-diode (PIN).
- Reception band: 400 - 1100 nm (for 90% efficiency).
- FSMA connector.

Infrared Receiver:
- Type: Photo-diode (PIN).
- Reception band: 800 - 1000 nm (for 50% efficiency).

27 MHz Receiver:
- Type: Envelope detector.
- Reception band: 27 MHz.
- Antenna: Monopole. 5 mm cable, 150 cm length.
- Connector: BNC female adapter.

ACCESSORIES AND DOCUMENTATION INCLUDED

- Antenna cables for radio transmission/reception.
- Optical fibre PMMA with FSMA connectors.
- Two wire and coaxial cables.
- Headphone and dynamic microphone.
- User's Manual.
- Theory Manual.
- Instruction manual and technical data.

Recommended equipment:

Digital Oscilloscopes	Series OD-4xx, OD-57x, OD-59x
Signal generators	GF-230, GF-232, GF-941

Technology

Fibre Optic Communications Training System

*The **EF-970E** trainer is an innovative system designed for training, demonstration and experimentation with the Fibre Optics communication systems, the phenomenon related to light and the principles of transmission through Optical Fibres; as well as the latest tendencies like LASER and WDM (wavelength multiplexing). The equipment consists of:*

- *Emitter module, two independent channels with photo-emitters and LASER.*
- *Receptor module with optical power measurements.*
- *Accessories.*
- *A set of Optic Fibres.*
- *Documentation.*

TRANSMITTER MODULE

RECEIVER MODULE

EMITTER KIT, CONSISTING OF TWO INDEPENDENT CHANNELS WITH LED AND LASER-PHOTOEMITTERS

8 INPUTS

The instrument possesses eight selectionable inputs. The input signal may be selected, either channel 1 (CH 1) or channel 2 (CH 2), the same input may also be used for both channels.

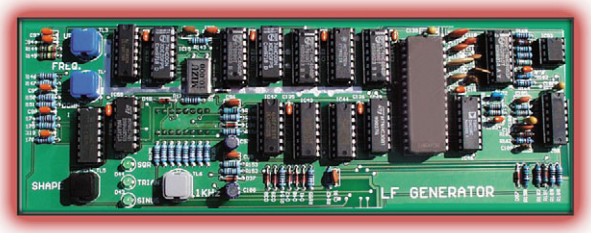
- LF generator: sinusoidal, triangular or square (internal) signal.
- DC analogue input (75 Ω) (external).
- AC analogue input (75 Ω) (external).
- Microphone (monophonic) (external).
- Digital input (External).
- Inverted digital input (External).
- Digital input permanently on "1" (internal).
- Digital switch "1" / "0", using the TL1 key (internal).

CHANNEL 1 AND 2

The transmitter has 2 independent channels (1 and 2), which allow to transmit from any optic input, monitoring the amplification level and the polarization.

LF GENERATOR (SQUARE, TRIANGULAR, SINUSOIDAL)

The BF generator possesses four control buttons to select the wave form (square, triangular or sinusoidal) and the frequency.



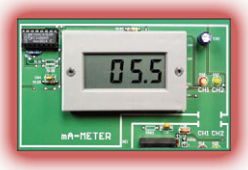
Fibre Optic Communications Training System

OPTICAL OUTPUTS

The emitter kit has six cyclically selectable photoemitters. Two photoemitters may be activated at the same time for the WDM application (*). The photoemitters have a protection circuit to limit optical power.

MILLIAMMETER

The emitter kit consists of a digital milliammeter showing the polarisation current flowing through the chosen photoemitter. The channel to be measured is selected with the "mA METER CH1/CH2" button.



LASER FEEDBACK

The nature of the LASER means that its optical power may be influenced by external factors such as temperature, ageing, etc.

The feedback circuit is able to maintain a stable and unalterable optical power no matter what the external conditions are.

The system can operate with the feedback circuit ON or OFF so to test its efficiency and the problems caused by its disconnection and/or malfunction.

RECEIVER KIT WITH OPTICAL POWER METER

RECEIVER

The receiver kit principally consists of two independent blocks (except for the input circuits: photodetectors and switches), one for the signal and the other for measuring.

The signal block contains two channels, also independent, one for receiving analogue signals and the other for digital signals.

The measuring block contains the power meter, enabling operation in four different modes: analogue, digital, 1 kHz and DC.

OPTICAL INPUTS

The receiver has four incorporated photodetectors and an external photodetector (optional) that connects to the "EXT. SENSOR" input by a coaxial cable (optional).

DIGITAL CHANNEL SIGNAL BLOCK

The signal entering the digital channel follows a series of filtering and amplification processes for subsequent comparison with a reference level.

The amplitude of the channel output may be selected as either TTL level or RS-232 level.

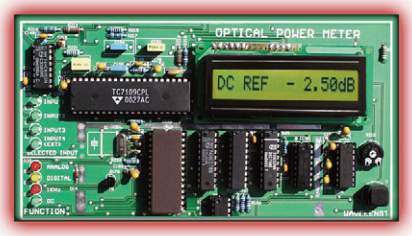
(*) Option OP-970-01 required

OPTICAL POWER METER

This block performs the absolute or relative measurement of the received optical power. The optical meter possesses four measuring modes, selected by the user.

- ANALOG (monitoring mode).
- DIGITAL (monitoring mode).
- 1 kHz (precision mode, for measuring the 1 kHz component).
- DC (precision mode).

The resolution of the power meter in the monitoring modes is 0.1 dB, and 0.01 dB in the precision modes.



ANALOGUE CHANNEL SIGNAL BLOCK

The resolution of the power meter in the monitoring modes is 0.1 dB, and 0.01 dB in the precision modes.

The signal block possesses a switch to select the type of coupling, DC or AC, applied to the first amplifier input and to the analogue channel output section.

The audio section consists of an independently-adjustable low-pass for regulating the level of the signal applied to the internal speaker or headphones.

Technology

Fibre Optic Communications Training System

EF-970 BASIC FIBRE OPTIC COMMUNICATIONS TRAINING SYSTEM

The **EF-970** is a simplified version of the **EF-970-E**, including five photo-emitters and two photo-detectors. The rest of features are the same as those of the **EF-970-E**. If desired, the **EF-970** can be upgraded to the **EF-970-E** with the **OP-970-EU** option.

INCLUDED ACCESSORIES

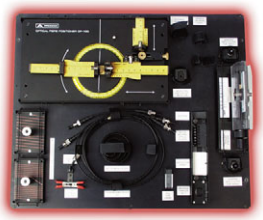
Both **EF-970-E** and **EF-970** include the following accessories:

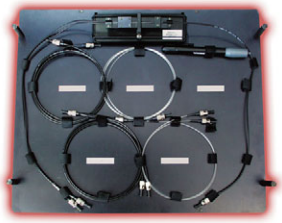
- 3 ST adapters for the photodetectors.
- Cleaning elements for optical components.
- 3 1-m pieces of optical fibre.
- 1 1-m piece of optical fibre without protective covering.
- 1 50-m optical fibre.
- 2 ST-ST adapters.
- 1 magnifying lens.
- 1 microphone.
- 1 headphones.

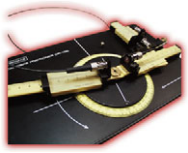
OPTIONS

OP-970-01: EXERCISES KIT

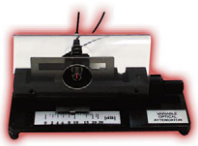
- 1 2-m piece of optical fibre.
- 1 2-m piece of optical fibre without protective covering.
- 1 set of modal filters (cylindrical hoops with various radiuses).
- 2 clips for modal filters.
- 1 set of plaques for generating high-density microcurves.
- 1 set of plaques for generating low-density microcurves.
- 1 optical fibre arm.
- 2 fixed WDM devices.
- 1 variable WDM device.
- 1 white light source (powered by two LR03 1.5 V alkaline batteries, not supplied).
- 1 set of neutral optical filters.
- 1 universal bracket (# 1).
- 1 universal bracket (# 2).
- 1 variable attenuator.
- 1 ST adapter for 650 nm filter photo-detectors.
- 1 ST adapter for 850 nm filter photo-detectors.
- 1 shutter (diaphragm).
- 1 reflection sensor.
- 1 reflecting lamina.
- 1 U-sensor.
- 1 liquid container.
- 1 external photo-detector (1 mm Si PIN).
- 1 measurement adapter (for external photo-detector).
- 1 shielded connector cable for external photo-detector.
- 1 screwdriver







OPTICAL FIBRE ARM



VARIABLE OPTICAL ATTENUATOR

VARIABLE WDM DEVICE

OP-970-02: CONNECTION KIT

- 1 tool for removing the protective covering from optical fibre.
- 1 ST crimping tool.
- 1 polishing disk.
- 1 set of abrasive lamina.
- 1 elastic polishing pad.
- 1 rigid pad.
- 1 liquid container.
- 1 10- m optical fibre cable.
- 10 ST connectors.

OP-970-03: MICROSCOPE

- 1 Universal Microscope (ST, FC, SC) x 100.

OP-970-EU: EXTENSION KIT FOR BASIC FIBRE OPTICS COMMUNICATIONS TRAINING SYSTEM (factory assembly)

Upgrades the basic Fibre Optics Trainer (**EF-970**) to the same characteristics as the **EF-970-E**.

- Photo-emitter 1300 nm LED.
- 1 mm InGaAs PIN photo-detector.
- 0.1 mm Ge APD (variable internal gain photo-detector).

Fibre Optic Communications Training System

EMITTER MODULE

The emitter kit for the simultaneous transmission of two independent channels of up to 10 MHz, consists of the following blocks:

Inputs
- Analogue (separate DC and AC).
- Functions generator (internal).
- Microphone.
- Digital (with possibility of inversion).

Emitter stage
- Channel 1.
- Channel 2, with actionable laser feedback.

Amperimeter
For adjusting photoemitter polarisation current

Photoemitters
526, 590, 660, 850, 1300 nm LED **. 650 nm Laser.

RECEIVER MODULE

Photo-detectors
- 1 mm Si PIN.
- 1mm InGaAs PIN **.
- 0.1 mm Ge APD (variable internal gain photodetector) **.
- 2.5 mm Si PIN.

Precision measurements channels
- 1 kHz, to prevent influence from external optical sources.
- Very low DC noise, for very precise measurements.

Receptor stages (with variable inverse polarisation)
- Analogue channel.
- Digital channel.

Optical power meter (dBm and mW), absolute/relative measurem.
Outputs
- Analogue (high or low impedance).
- Digital (TTL or RS-232).
- Speaker (internal) and headphones.

Fault simulator

CD-ROM SUPPLIED DOCUMENTATION

- User's Manual.
- Training Manual.
- Teacher's Manual.

PARTIAL LIST OF EXERCISES

EF-970
- Measuring optical power (suggested **EF-970-E**).
- Measuring the attenuation of an optical fibre. Insertion losses method (suggested **EF-970-E**).
- Measuring the attenuation of an optical fibre.
- Spectral dependence of the attenuation of an optical fibre.
- Influence of ambient light.
- Connecting optical fibre using ST-ST adapters. Measuring repeatability.
- Measuring the P/I characteristics of photoemitters.
- Measuring the optical stability of photo-emitters.
- Inverse voltage in photo-detectors.
- Measuring the V/I characteristics of photo-emitters.
- Frequency characteristics of photo-emitter modulation.
- Spectral dependence of photo-detectors (suggested **EF-970-E**).
- Bandwidth of photo-detectors.
- Transmission of analogue signals.
- Transmission of audio signals.
- Transmission of video signals.
- Transmission of digital signals.
- RS-232 transmission using optical fibres.

EF-970-E
- Optical power measurement.
- Measuring the attenuation of an optical fibre. Insertion losses method.
- Measuring the attenuation of an optical fibre.
- Spectral dependence of the attenuation of an optical fibre.
- Influence of ambient light.
- Connecting optical fibre using ST-ST adapters. Measuring repeatability.
- Measuring the P/I characteristics of photo-emitters.
- Measuring the optical stability of photo-emitters.
- Measuring the V/I characteristics of photo-emitters.
- Frequency characteristics of photo-emitter modulation.
- Spectral dependence of photo-detectors.
- Inverse voltage in photo-detectors.
- Bandwidth of photo-detectors.
- Transmission of analogue signals.
- Transmission of audio signals.
- Transmission of video signals.
- Transmission of digital signals.
- RS-232 transmission by optical fibres.

OP-970-01 EXERCISES KIT
- Sensitivity of optical fibre to curvature (Macrocurves).
- Sensitivity of optical fibre to microcurvature.
- Radiation characteristics of optical fibre. Measuring numeric aperture.
- Measuring sliding in optical fibre connections.
- Characteristics of a fixed WDM device.
- Characteristics of a variable WDM device.
- Measurements with neutral optical fibres.
- Measuring insertion loss by the variable optical attenuator.
- WDM: multiplexation and demultiplexation.
- WDM system.
- WDM transmission.
- Transmission sensor.
- Reflection sensor.
- Liquid level sensor.
- Spectral dependence insertion loss by the variable optical attenuator (**EF-970-E** needed).
- Comparing noise characteristics between PIN and APD photodetectors (**EF-970-E** needed).

OP-970-02 CONNECTION KIT
- Connections with the optical fibre connector tool kit **EF-970** or **EF-970-E**.

OP-970-03 MICROSCOPE
- Recommended for use with **OP-970-02**.

(**) This item is not supplied with EF-970 model

Recommended equipment:

Digital Oscilloscopes	Series OD-4xx / OD-57x, OD-59x
TV signal generators	GV-198, GV-698+, GV-798+
Optical power meter	PROLITE-23
Optical spectrum analyser	PROLITE-60

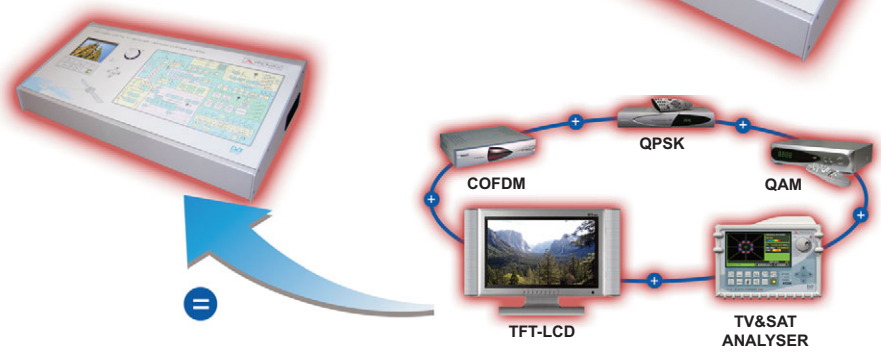
Universal Digital TV Receiver Trainer

Technology

*The Universal Digital TV Receiver Trainer **EU-850** is a didactic equipment oriented to the learning of the theoretical and practical contents about the operation of the digital television receivers (satellite, terrestrial and cable) as well as the basis and the processes related to the transmission, reception and distribution of the digital television (COFDM, QPSK and QAM).*

In order to make easy the learning and understanding process, the trainer includes a block diagram which represents a generic structure of a modern digital television universal receiver, with an extensive set of test points that allow the analysis of the signals that take part in the different reception processes.

The equipment includes a 5"-TFT hi-res graphical display, that allows the visualisation of the digital channels tuned (and the analogue channels when terrestrial reception), and also offers all the features of a professional field strength meter.

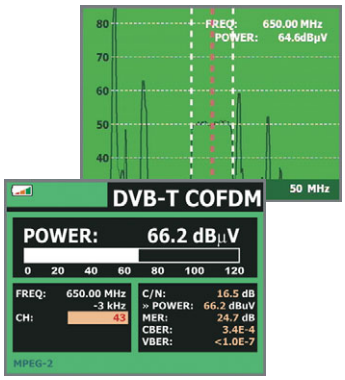


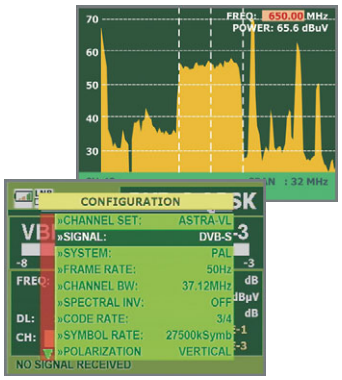
In the aspect of measures, highlights the spectrum dynamic exploration to detect all the transmissions existing in the explored band, the measurement of power level, the carrier/noise ratio (C/N), the digital signal error rate (BER) and the modulation error ratio (MER), as much for DVB-T (COFDM) signals as DVB-S (QPSK) and DVB-C (QAM) signals.

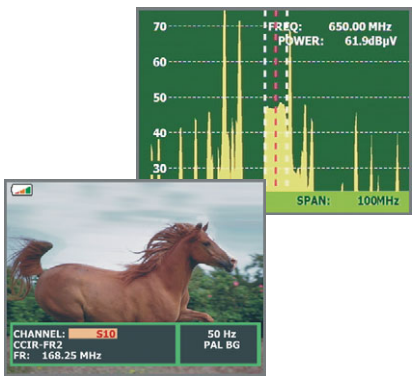
The trainer accepts the main world-wide digital TV standards (DVB-T, DVB-C, DVB-S) analog TV (M,N,B,G,I,D,K and L) and any TV standard (PAL, SECAM and NTSC). Due to it is a multistandard equipment, it can efficiently be used in any country of the world.

A CD-ROM is included that contains the following documentation in PDF format:

- Exercices Manual (Theoretical bases included).
- Training Manual.







Trade Mark of the DVB Digital Video Broadcasting Project (4029)

Universal Digital TV Receiver Trainer

SPECIFICATIONS

- **Tuning:** from 45 to 865 and from 950 MHz to 2150 MHz.
- **Digital reception:**
  Terrestrial (COFDM), Satellite (QPSK) and Cable (QAM).
  Video: MPEG-2/DVB (MP@ML) format. Services decoding, service list and PIDs.
- **Analogue reception:**
  Terrestrial (PAL, SECAM and NTSC systems and M, N, B, G, I, D, K and L standards).
- **Automatic identification** of Analogue and Digital signals.
- **Screen:** 5 " TFT-LCD Colour.
- Built-in **loudspeaker**.
- **Scart connector**.
- **Active block diagram** with Test Points.
- **External units power supply, 22 kHz signal and DISEqC 1.2**.
- **Spectrum analyser**.
- **Digital signals measurements:**
  DVB-T (COFDM): Power, CBER, VBER, MER, C/N.
  DVB-C (QAM): Power, BER, MER, C/N.
  DVB-S (QPSK): Power, CBER, VBER, MER, C/N.
- **COFDM signal parameters:**
  Carriers 2k/8k (Selectable by the user).
  Guard interval of 1/4, 1/8, 1/16, 1/32 (Selectable by the user).
  Code Rate 1/2, 2/3, 3/4, 5/6, 7/8.
  Modulation QPSK, 16-QAM, 64-QAM.
  Spectral inversion selectable: ON, OFF.
  Hierarchy: Hierarchic mode indication.
- **QAM signal parameters:**
  Demodulation 16/32/64/128/256 QAM.
  Symbol rate: 1000 to 7000 kbauds.
  Spectral inversion selectable: ON, OFF.
  QPSK signal parameters.
  Symbol rate: 2 to 45 Mbauds.
  Code Rate 1/2, 2/3, 3/4, 5/6, 7/8 and AUTO.
  Spectral inversion selectable: ON, OFF.
- **Analogue Signals Measurements**.

Recommended equipment:

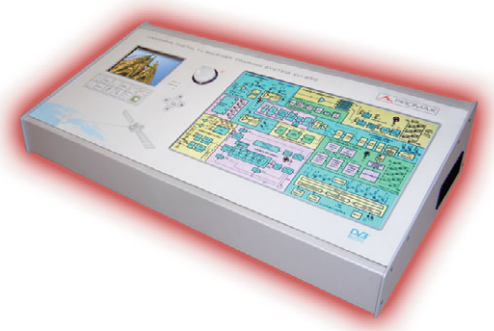
TV signal generators	MPEG-2 pattern generator GV-998
COFDM Modulators	MO-170, MO-163
Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x

Technology

DVB-T Transmitter-Receiver System

OPT-850-A *optional kit consists of one QPSK to COFDM transmodulator, two yagi antennas, cables and connectors. It allows to* ***widen the EU-850 applications****, making it perfect for Digital Television analysis laboratory.*

The transmodulator allows to ***obtain a COFDM DVB-T signal*** *with the desired parameters (number of carriers, code rate, constellation, guard interval..) and with selectable frequency (from 45 to 875 MHz) and ready to broadcast by means of an antenna or a cable TV network*



Thanks to the possibility of **DVB-T signals broadcasting** through an antenna it is possible to simulate a real broadcast transmission. Moreover, using an additional antenna it makes possible the analysis of the DVB-T signal including every parameter involved, in such way that the student is able to understand the pros and cons of the different configurations.

By means of the use of **OPT-870-A** option the student will experience every concept related to DVB-T:

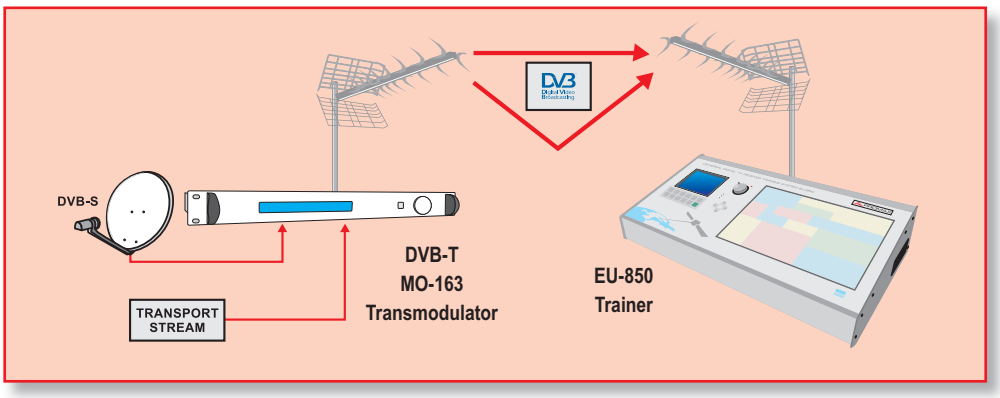
- Number of carriers (2K or 8K).
- Constellation (QPSK, 16-QAM, 64-QAM).
- Guard interval.
- Code rate.
- Hierarchical Transmission.
- Bitrate.
- Bandwidth.
- Spectral inversion.
- Transmitted power.
- Etc.

The chance to **change the parameters of the DVB-T** makes possible for the student to experiment on the results of them on the transport stream.

The transmodulator can use an external transport stream or generate it internally. The external transport stream will be **generated from the DVB-S input** (the transmodulator will use its built in DVB-S receiver) o directly from its serial input (ASI); in both cases the student can adjust the transport stream bitrate to adapt it to the input speed required.

OPT-850-A consists of:

- MO-163 transmodulator.
- 2 high performance UHF Yagi antennas.
- Coaxial cable.
- Connectors.
- Practice manual (with theory).
- Instructions manual.



OPT-850-A makes possible to transmit
from a MPEG-2 transport stream or using a DVB-S as input.

Recommended equipment:

Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x.
TV signal generators	GV-998

DVB Trade Mark of the DVB Digital Video Broadcasting Project (4029)

Transmitter-Receiver DVB-T System

SPECIFICATIONS	EU-850
TUNING	From 45 to 865 and from 950 MHz to 2150 MHz
DIGITAL RECEPTION	Terrestrial (COFDM), Satellite (QPSK) and Cable (QAM). MPEG-2/DVB (MP@ML). Services decoding, service list and PIDs.
ANALOGUE RECEPTION	Terrestrial (PAL, SECAM, NTSC, standards M, N, B, G, I, D, K and L).
FEATURES	Automatic identification of Analogue and Digital signals. 5 " TFT-LCD Colour, Scart. Built-in loudspeaker. Spectrum analyser. Active block diagram with Test Points. External units power supply, 22 kHz signal and DISEqC 1.2.
DIGITAL MEASUREMENTS & PARAMETERS	
COFDM	Power, CBER, VBER, MER, C/N.
Carriers	2k / 8k (Selectable by the user).
Guard interval	1/4, 1/8, 1/16, 1/32 (Selectable by the user).
Code Rate	1/2, 2/3, 3/4, 5/6, 7/8.
Modulation	QPSK, 16-QAM, 64-QAM.
Spectral inversion	Selectable: ON, OFF.
Hierarchy	Hierarchic mode indication.
QAM	Power, BER, MER, C/N.
Demodulation	16/32/64/128/256 QAM.
Symbol rate	1000 a 7000 kbauds.
Spectral inversion	Selectable: ON, OFF.
QPSK	Power, CBER, VBER, MER, C/N.
Symbol rate	From 2 to 45 Mbauds.
Code Rate	1/2, 2/3, 3/4, 5/6, 7/8 and AUTO.
Spectral inversion	Selectable: ON, OFF.

SPECIFICATIONS	MO-163
INPUTS	
QPSK	F female connector, From 950 to 2150 MHz (between -65 to -25 dBm).
MPEG-2 Transport Stream	2xASI, 75 Ω BNC f. 188/204 bytes packets auto detec. Burst / continuous packet modes.
Operating modes	Master and slave mode.
IF OUTPUT	50 Ω BNC female connector.
Frequency range	From 32 to 36 MHz (1 Hz steps). Fixed at 36 MHz when RF output is off.
Spectrum polarity	Selectable via front panel controls.
Power level (average)	0 dBm (107 dBmV) fixed.
In-band amplitude ripple	< 0.2 dB.
In-band group delay ripple	< 10 ns.
Frequency stability	20 ppm.
Out-of-band spectral characteristics	
@ ± 3.805 MHz	0 dBc.
@ ± 4.25 MHz	-46 dBc (2k), -56 dBc (8k).
@ ± 5.25 MHz	-56 dBc.
IQ amplitude imbalance	< 0.02%.
IQ quadrature error	< 0.02º.
Central carrier suppression	< -55 dBc.
Harmonics and spurious	< -60 dBc.
MER	> 43 dB.
RF OUTPUT	50 Ω N-type female connector. From 45 to 875 MHz (1 Hz steps).
Spectrum polarity	Selectable via front panel controls.
Power level (average)	-87 to -27 dBm in 1 dB steps (optional up to +6 dBm).
Level of harmonic and spurious	< -50 dBc.
Frequency stability	20 ppm.
MER	> 36 dB.
SSB phase noise	≤ -87 dBc/Hz @ 2 kHz.
DVB-T PARAMETERS	
IFFT size	2k, 8k.
Guard intervals	1/4, 1/8, 1/16, 1/32.
Code rates	1/2, 2/3, 3/4, 5/6, 7/8.
Symbol interleaver	Native.
Constellations	QPSK, 16-QAM, 64-QAM.
Hierarchical modes	16QAM and 64QAM constellations with constellation ratio α = 1, 2 or 4.
MFN operation	Available.
TPS signalling	Cell ID.
Channel bandwidth	6, 7 and 8 MHz (user selectable).
PROGRAM SELECTION	Service selection without table rebuilding (PID Filtering).
REMOTE CONTROL	Fast Ethernet (RJ-45 connector).
POWER SUPPLY	90 - 250 V AC (50 - 60 Hz), 20 W.

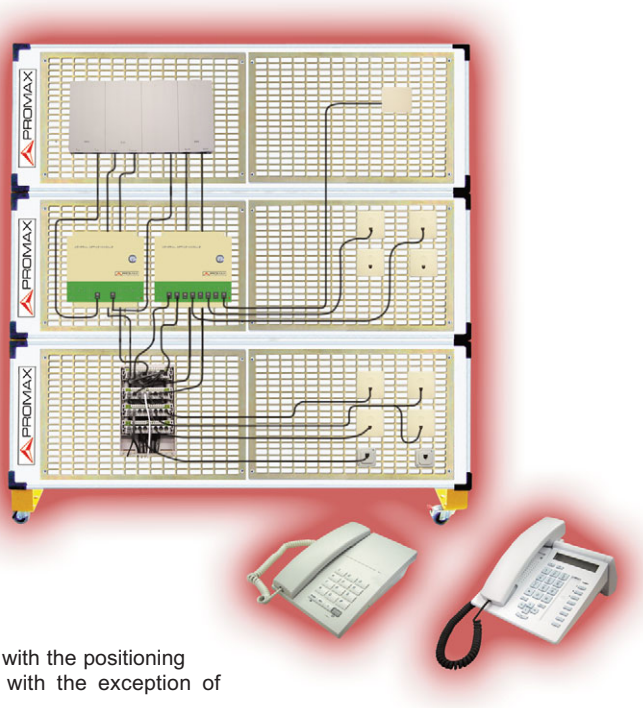
Technology

Telephony Training System

*The Telephony Trainer **ET-836** is an educational integral system destined to the learning of the theory and the practise of PABX stations, the indoor telephony networks and the telephony systems, as well as to the development of the skills of installation and assembly.*
It works as a standalone training system, with no need of any telephone line for the trainee sessions. The system is capable of carry out internal calls and also to simulate, transparently to the user, incoming or outgoing calls from outside the system.

The training system is fully configurable, based on a white slate support with removable universal panels of fast fixation, composed by the following elements:

- Last generation of PABX station, with 2 external analogue lines, 4 indoor analogue lines and 4 ISDN lines (basic access So: B+B+D).
- Urban Central module (which incorporates tarification circuits controlable by the user) that provides 2 external lines, simulating an urban analogue central telephone office, and allows the generation of failures.
- Canalisation Module that allows the generation of failures on the internal telephone lines and the variation of its parameters.
- Telephone distributor, for the interconnection and allocation of lines.



Also are included telephone bases for the connexion of the analogue terminals and RDSI are included, cables, connectors and tools to implement any typology of telephony network.

The fast fixation universal panels have their surface grooved, of such form that the disposition of the drills combined with the positioning of the nuts allows the fixation of all the provided elements, with the exception of the telephone terminals.

Each one of the **ET-836** modules has an active block diagram, with telephone connectors and test points, that allow the connexion of telephone lines and the terminals. In the test points the telephone signals can be observed, to analyse their different states and to measure their parameters. Also they allow the study of the typical errors of wiring.

PABX station can be connected to a PC, via modem or directly, through Software of Programming and Configuration.

From his PC, the student can control, analyze and configure the management of the PABX system. **Software also can run off-line so that they can be made practices of programming in any PC with no need of the trainer.**.

The Urban analogue telephone station module, simulates the external analogue lines of a public telephone station, so that they can be generated external calls or to receive outer calls independently, with no need to require of the hiring of real telephone lines.

Telephony Training System

The Urban analogue telephone station module incorporates two circuits of impulses generation for the management of the tarification of the external calls and in which different situations are simulated, also diverse parameters can be altered so that the student observes the effects.

The Canalisation module allows generating failures on the analogue lines and ISDN, of the indoor telephony network, as well as to vary its parameters and to enter diaphonies.

In addition, from a PC, also different failures in PABX station can be introduced. The software provided also allows that the teacher can design new failures.

The trainer is provided with an installation mounted and set, so that the equipment is fully operative from the first day, with no need to carry out neither connexions nor commissioning.

LAST GENERATION OF ISDN/ANALOGUE TELEPHONE STATION

- **No. of external analogue lines**: 2.
- **No. of internal analogue lines**: 4.
- **No. of internal basic accesses So (B+B+D)**: 4 (it allows the connexion up to 8 independent ISDN extensions).
- **Programming** and setting up the station through PC.

CHANNEL MANAGEMENT MODULE

- **Number of analog telephone lines supported**: 2
- **Number of Basic Rate Interfaces supported**: 2
- **Line selection**: cyclical by means of push button.
- **Configurable parameters** of the selected line:
  - Capacity.
  - Isolation.
  - Crosstalk.
  - Attenuation.
- **Block diagram with test points**. It makes possible to monitor, analyze and measure the telephone lines.
- **Key lock**, to avoid internal access.

TELEPHONE EXCHANGE MODULE

- **Number of external analog telephone lines**: 2
- **Number of call-rating circuits**: 2 (independents).
- **Configurable parameters**:
  - Impulse sending ratio (speed).
  - Impulse frequency.
  - Impulse amplitude.
- **Failure simulation** in the call-rating circuits.
- **Block diagram** with test points. It makes possible to monitor, analyze the internal signals of the call-rating circuits and to get measurements of the telephone line signals.
- **Key lock**, to avoid internal access.

TELEPHONE SWITCH

- **Number of ports**: 20.
- **Number of circuits**: 5.
- **Circuits capacity**:
  - 8 RJ-11 connectors (4 contacts and 8 positions).
  - 2 LSA 8 contacts connector.

INCLUDED ELEMENTS

- **Telephone terminals**:
  - 1 ISDN terminal with alphanumeric display.
  - 2 analogue terminals.
- **Documentation (in CD-ROM)**:
  - User's Manual.
  - Exercise Manual.
  - Teacher's Manual.
  - Technical Documentation about telephone station analogue/ISDN.
- **Accessories**:
  - Tool for connector's assembly.
  - Telephone Cable.
  - RJ11 and RJ45 connectors.
  - Insertion tool.
  - Set of interconnection cables.
  - Telephone Bases of wall type RJ11 and RJ45.
  - Cable connexion series telephone station-PC.
  - Nuts and screws of fixation for the universal panels of fast fixation.
  - Labelling.
- **Software**:
  - Software of Programming and Configuration of PABX station - for Windows (available in the following languages: Spanish, English, French).
  - Setup Software.
  - Failures Software.

Recommended equipment:

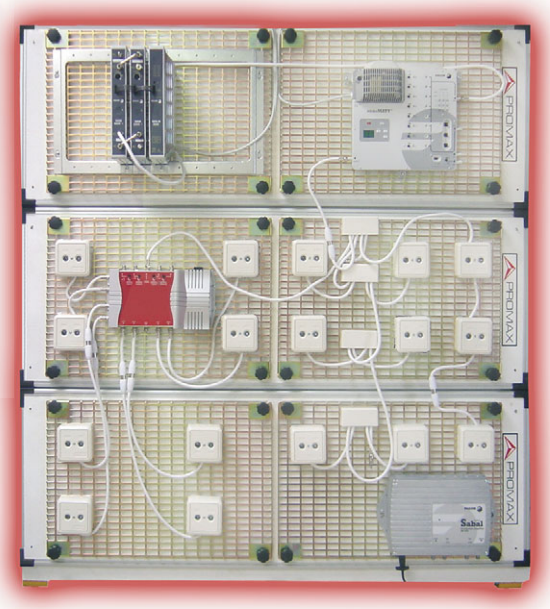
Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x
Digital multimeters	Series PD-16x, PD-18x
Wiring Tester	TC-470, TC-471
Telephony tester	IC-008B

Television Antenna Training System

*The Antenna Training System **EA-815F** is a very versatile education system for teaching, demo purposes and practice in:*

- *Digital and Analogue Terrestrial Television facilities (MATV).*
- *Digital and Analogue Satellite Television with IF and channel processing (SMATV).*
- *Cable television (CATV).*

likewise for the assembly and installation skills development.



This training system is fully configurable, based on a whiteboard structure. Each board is made up of 2 detachable plates. The student can configure, adjust, install, modify and analyze any kind of actual installations of MATC, SMATV and CATV.

The universal plates are easily removable from the boards, in such a way that the system will be divided into different subsystems in order to be operated by different student groups and making possible to do it simultaneously. Once every part is assembled, each universal plate should be fixed to the board brackets. Afterwards every connection should be made and eventually the system is ready to be programmed.

The white blackboard panels are erasable, what enables the teacher to draw the receiver configuration, amplifier, and distribution to be implemented by the students. It's also possible to make notes.

The universal plates are quickly detachable or fixed. They have a surface with grooves, in such a way that every component can be easily mounted and fixed using the provided fastening nuts. Once every teaching practice is finished, the different parts that form the installation are very easy to dismantle to make it ready for the next exercise.

The training system is supplied with an already mounted and configured antenna installation. Thus the system is ready to be operated and used from the first day.

Its flexibility enables the student to test and practice with the various solutions for the installation suggested by the teacher, and then to compare the pros and cons of every possibility. Moreover, failures and breakdowns can be simulated by the teacher and then asked to be solved.

Jointly is provided a Digital Television receiver (DVB-T) and one digital satellite receiver (DVB-S), just like that one IF simulator and accessories for propping up the antenna.

In order to implement any other typology or to modify the installation already mounted, several materials are supplied: coaxial cable, connectors, coaxial cable tool, and mounting elements.

Apart from that, are included: exercise manuals, technical documents manual what describes every part which compose the trainer and, finally, a handbook what contains the regulation and standards involved.

DVB Digital Video Broadcasting

Television Antenna Training System

ANTENNAS

- UHF Antenna.
- Offset antenna, consists of:
  - Reflector.
  - LNB with 4 outputs (H/L, V/L, H/H, V/H).
  - Accessories: LNB stand and fastening elements.

MECHANIC ACCESSORIES

- 150 cm mast for terrestrial antenna.
- 80 cm mast for offset antenna.
- Mobile stand for the antennas.

HEADEND EQUIPMENT

- MATV (built in one module):
  - 8 programmable UHF amplifiers set.
  - VHF amplifier.
  - Power supply.
- SMATV through RF:
  - IF-UHF internal programmable units.
  - Universal programmer.
  - Power supply.

MATV FOR BUILDING DISTRIBUTION AND SINGLE INSTALLATIONS

- Splitters/Combiners.
- Taps.
- TV sockets.
- Through outlets and end outlets.

SMATV FOR BUILDING DISTRIBUTION AND SINGLE INSTALLATIONS (F)

- Distributor switchable 5x8, with built in amplifier.
- IF input.

CATV FOR BUILDING DISTRIBUTION

- CATV line amplifier with attenuator and slope control.
- Active return path with gain control.

USER EQUIPMENT

- Digital Terrestrial TV receiver (DVB-T).
- Digital Satellite TV receiver (DVB-S).

ACCESSORIES FOR ANTENNA POINTING

- Tilt measurement instrument.
- Compass.

ACCESSORIES, CABLES AND OTHER TOOLS

- Coaxial cable reel (25m).
- F- male connectors (25 units).
- TV male connectors (25 units).
- TV female connectors (25 units).
- Tools for coaxial cable.
- Markers for blackboard (2 units).
- Screws and nuts for universal plates quick mounting.

OTHER ACCESSORIES

- Impedance loads.
- Jumpers.

INSTRUMENTATION

- Intermediate frequency simulator (RP-050).

DOCUMENTATION (in CD-ROM)

- Theory and Practice Manual (Intermediate level).
- Theory and Practice Manual (Upper level).
- Training system instructions manual.
- Technical documents.
- Mounting instructions.
- Regulation and standards.

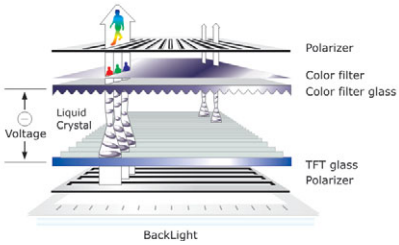
Recommended equipment:

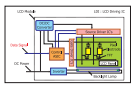
TV signal generators	GV-998, GV-898+, GV-798+, GV-698+
Field strength meters	TV Explorer, TV Explorer *II* / *II+*, PROLINK-3C/4C *Premium*
Carrier generators	RP-200, RP-250
COFDM Modulators	MO-170, MO-163

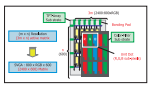
Flat Screen Digital Terrestrial TV Training System

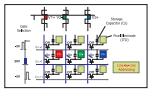
*The **ET-893** is a suitable equipment for the learning of the flat screen television sets operation equipped with TFT-LCD and Plasma technology that allows the student to become familiar with the more advanced technological innovations, likewise for the reception of Digital Terrestrial Television (DVB-T). The trainer includes a failures generation module.*

*The **ET-893** block diagram shows through an intuitive way the different stages that compounds the flat screen receiver.*









With a wide number of test points, makes possible a thorough analysis and tracking of the electrical signals in the different blocks from the receiver. All the test points are protected against accidental short-circuits. By means of the failures module it is possible to simulate the more frequent failures than they can take place in the receiver in order that the student learns to carry out methods of diagnosis and trouble-shooting.

Special attention has been dedicated to develop a fully functional design with a small size.

DVB Digital Video Broadcasting TERRESTRIAL

TV TFT-LCD RECEIVER

- Screen size 20".
- 4:3 format.
- Resolution: 640x480 pixels.
- TV systems: PAL B/G/I/D/K and SECAM B/G/D/K/L/L'.
- Scart connector.
- Two A/V outputs: SVHS, L/R and Video.
- Audio Output: L/R Out.
- Earphone output.
- PC connexion: VGA connector and audio mini-jack connector.
- Audio analogue Zweiton system (PAL G).
- Audio digitalis system NICAM (PAL G).
- Teletext.
- On Screen Display (OSD).
- Remote Control by IR.

FAILURES SIMULATOR

A set of microswitches allows to cause a wide number of real failures on the TV receiver, in such a way that the teacher is able to evaluate the student's ability to diagnose and find the failure.

BLOCK DIAGRAM

The block diagram is made up of the following functional module:

- Power supply.
- DVB-T.
- IF and Demodulador.
- Video Processing.
- Audio Processing.
- System Control.
- Inputs/Outputs.
- Climbing circuit.

DOCUMENTATION INCLUDED (IN CD-ROM)

- Training Manual.
- Teacher's Manual.
- Exercises Manual.
- Technical Documentation and Circuits Description Manual.

ACCESSORIES

- Remote control.
- Batteries (Two R6 AA units).
- Scart connector cable.

(*) Also available ET-892, without built-in Digital Terrestrial TV receiver (DVB-T).

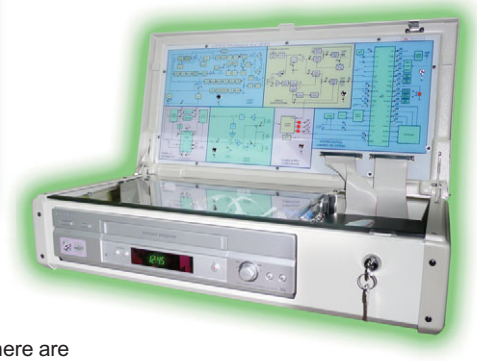
Recommended equipment:

TV signal generators	GV-998, GV-898+, GV-798+, GV-698+
COFDM Modulators	MO-170, MO-163
Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x
Field strength meters	TV Explorer, TV Explorer *II* / *II+*, PROLINK-3C/4C *Premium*

DVB Digital Video Broadcasting Trade Mark of the DVB Digital Video Broadcasting Project (6226)

Video Cassete Recorder Training system

*The **EV-830** video cassete trainer is a teaching equipment intended for training Professional students in an easy and enjoyable manner, which makes them possible to assimilate the operation and the repair techniques of VHS video equipment. It is accompanied by extensive documentation which includes User's Manual, Training Manual, Block Diagrams and Technical Documentation*



The **EV-830** has been designed on a multifunctional support which aids the analysis of the most important electric signals in the different modes of operation of the video, the inspection of all the movements of the mechanical elements and the simulation of the most frequent faults. Under the upper cover of the equipment, there are block diagrams of the video with a large number of test points which allow the visualisation and monitoring of the different electric signals in any mode of operation.

All the test points are protected against possible accidental short-circuits. The units can be stacked with the rest of the range and in their rest position they can be used as domestic desktop instruments.

VIDEO RECORDER-PLAYER

The **EV-830** incorporates a VHS video recorder manufactured with the most advanced technology, equipped with a high level of features and with a wide diffusion on the market. From among its characteristics we can highlight:

- PAL system.
- Automatic tuning.
- Two heads.
- Self-cleaning.
- Auto-tracking digital.
- Euroconnector.
- Frame-by-frame and pause.
- Automatic System for failure detection.

BLOCK DIAGRAMS

The block diagrams consist of the following functional modules, each one with the test points of the most important electric signals involved in its operation:

- Tuning.
- Video.
- Sound.
- Servosystems.
- Control System.
- Power supply.

FAULT SIMULATOR

The fault simulator manipulates electric points of the video, allowing a large number of test points to be simulated, in such a way that the teacher is able to evaluate the student's ability to diagnose and find the failure.

INCLUDED DOCUMENTATION (in CD-ROM)

- User's Manual.
- Training Manual.
- Electric diagrams and Technical Documentation.

The following documentation is also included (in paper):

- Theory Manual.
- Video Recorder-Player User's Manual.

ACCESSORIES

- Video Pattern Tape.
- Connection cables.

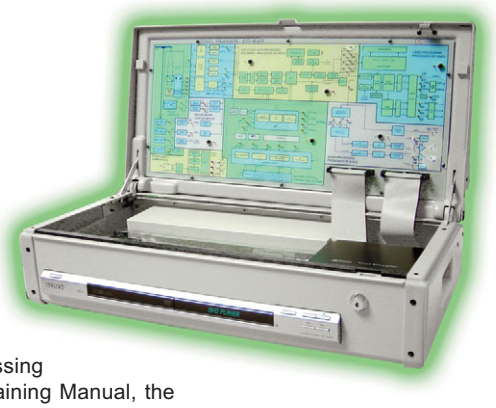
Consumer

Recommended equipment:

Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x
TV signal generators	GV-898+, GV-798+, GV-698+
Field strength meters	TV Explorer, TV Explorer *II* / *II+*, PROLINK-3C/4C *Premium*

DVD and CD Trainer (Region 2)

*The **ED-845** DVD & CD Player Trainer is an educational instrument designed for the theoretical/practical study of the workings of a DVD & CD player, as well as digital audio and video in DVD format (as in MPEG-2 and MPEG-4 ASP mode) and digital audio in CD format .*
The functional structure of the equipment enables its internal composition to be observed, the various signals involved in its operation analysed by means of a block diagram and faults introduced, all in order to aid the student learn diagnostic methods and how to locate breakdowns.



The trainer includes a DVD & CD player using the latest digital signal processing technology, and offering the best features found on the market today. In the training Manual, the theoretical aspects and the description of the circuits are also included basic that compose the equipment.

The instrument is backed up by extensive documentation (which includes a Teacher's Manual, a “Upcoming Digital Technologies Manual” and Technical Documentation Manual), a Test DVD disk, a Test CD disk, an infra-red remote control (batteries included) and a SCART cable.

The “Upcoming Digital Technologies Manual” presents the processes of coding audio-visual content as MPEG-2, MPEG-4, DivX, H.264 with special emphasis in the description of the DivX format.

Consumer

DVD & CD PLAYER

- Signal format: PAL/NTSC (without transcoding).
- Region 2.
- Disk player: DVD-VÍDEO, DVD-R, DVD-RW/-R, DVD+RW/+R, VÍDEO-CD, CD-AUDIO.
- MPEG-2, DivX (MPEG-4 ASP) and MP3 player.
- Outputs: Digital Out Coaxial, Line Out Audio, Video Line Out, Euroconnector.

BLOCK DIAGRAM

The printed block diagram allows a comfortable position for the student to access the test points without losing sight of the mechanics and electronics of the DVD player. The block diagram is made up of the following functional modules, each with the test points for the most important signals involved in operation:

- Pickup.
- DVD/CD RF amplifier.
- Servo DSP/Data Processing.
- Motor Driver.
- Video Processing.
- Audio Processing.
- System Control.
- Power Supply.

FAULT SIMMULATOR

The simulator of failures manipulates electrical points of the DVD allowing to cause a large number of real failures, in such a way that the teacher is able to evaluate the student’s ability to diagnose and find the failure.

INCLUDED DOCUMENTATION (in CD-ROM)

- User’s Manual.
- CD & DVD Player User’s Manual.
- Exercise Manual.
- Teacher’s Manual.
- Technical Documentation Manual.

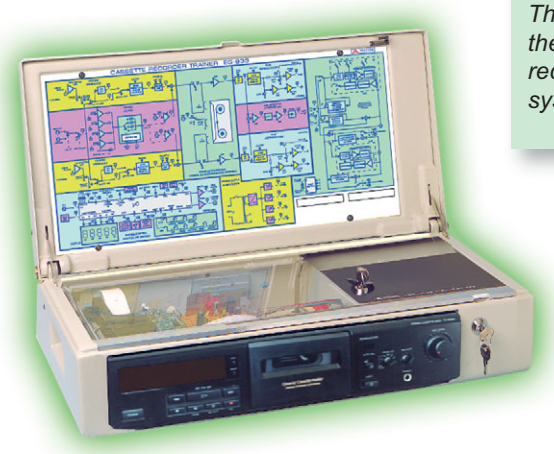
ACCESSORIES INCLUDED

- Remote control.
- 2 AA-format R6 units.
- Shielded Euroconnector Cable.
- Test DVD disk.
- Test CD disk.

Recommended equipment:

Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x

Cassette Recorder Training System



*The **EG-833** Trainer is an educational instrument designed for the theoretical/practical study of the operation of the cassette recorder/player magnetic systems, as well as the noise reduction system.*

The trainer **EG-833** is based on a high quality cassette recorder, with the most advanced recording, playback, polarization and noise reduction (Dolby B and C) circuits.

The large number of test points allows a detailed analysis of the main signals involved in different processes.

BLOCK DIAGRAMS

The block diagrams consist of the following functional modules:
- Input section.
- Recording process section.
- Playback process section.
- Output section.
- Noise reduction systems: Dolby© B and C.
- Control system.
- Servos.
- Automatic Music Search (AMS).
- Power supply.
- Fluorescent visualiser.

FAULT SIMULATOR

The fault simulator manipulates electric points of the cassette deck, allowing to simulate real faults, in such a way that the teacher is able to evaluate the student's ability to diagnose and find the failure.

The fault simulator manipulates electric points of the cassette deck, allowing to simulate real failures.

INCLUDED DOCUMENTATION (in CD-ROM)

- User's Manual.
- Training Manual.
- Teacher's Manual (Failures).
- Electric diagrams and Technical Documentation.

The following documentation is also included (in paper):
- Cassete Recorder User's Manual.

ACCESORIES

- Auto-amplified speakers.
- Test Tape.
- Connection cables.

MAGNETIC CASSETTE RECORDER/PLAYER

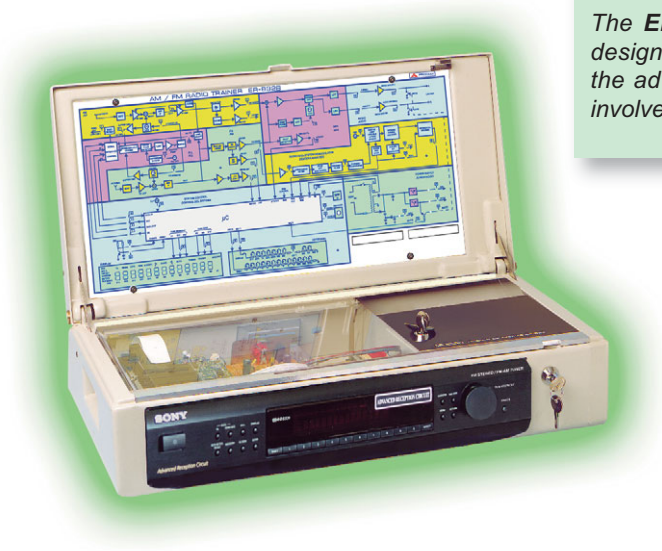
- Double Tape.
- Dolby© B and C.
- Automatic Tape Selector (ATS).
- Automatic Recording Level adjustment (ARL).
- Gradual rise and fade of the sound (FADER).
- Blank space insertion.
- Signal level indicator.
- Automatic Music Search (AMS).
- Selectable MPX filter.
- Headphone outputs.
- Synchronized recording.

Consumer

Recommended equipment:

Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x
Function Generator	GF-232, GF-230, GF-941

Radio Training System



*The **ER-832** Radio Training System is an educational instrument designed for the theoretical/practical study of the operation of the advanced radio receivers through analysis of the main signals involved in different processes.*

The trainer **ER-832** is based on a sophisticated stereo tuner with a Radio Data System (RDS) equipped with the latest digital technology and the most innovative reception circuits.

Using the most important technological advances in radio receivers, keeps the trainer ER-832 at a cutting edge until the digital radio (DAB) is consolidated.

Consumer

BLOCK DIAGRAMS

The block diagrams consist of the following functional modules:

- AM radio-frequency input section.
- AM intermediate frequency amplifier.
- AM oscillator and mixer section.
- AM detection.
- PLL synthesiser and frequency divider.
- FM radio-frequency input section.
- FM intermediate frequency amplifier.
- FM oscillator and mixer section.
- FM demodulator.
- Multiplex decoder.
- RDS demodulator.
- Output section.
- System control.
- Automatic tuning system and memories section.
- Power supply.

Each one of the functional sections has several test points which permit the analysis and monitoring of the main electrical signals of the tuner. All the test points are protected against possible accidental short-circuits.

FAULT SIMULATOR

The fault simulator manipulates electric points of the tuner, allowing to simulate real faults, in such a way that the teacher is able to evaluate the student's ability to diagnose and find the failure.

INCLUDED DOCUMENTATION

- Theory Manual.
- User's Manual.
- Radio Tuner User's Manual.
- Exercise Manual.
- Electric diagrams and Technical Documentation.
- Teacher's Manual.
- Manual of Circuits and diagrams.

ACCESSORIES INCLUDED

- Auto-amplified speakers.
- AM Antenna.
- FM Antenna.
- Connection cables.

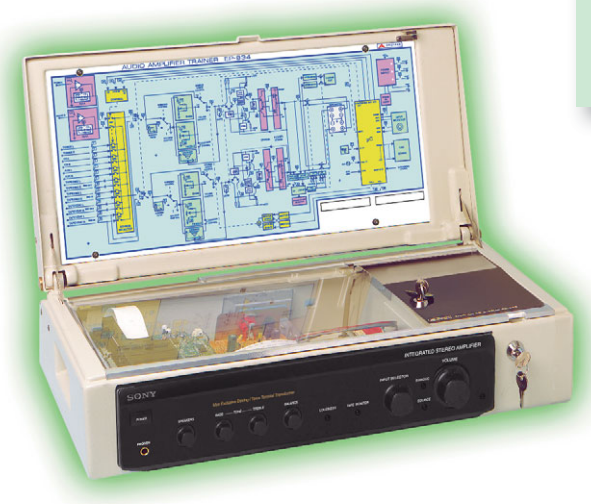
FUNCTIONS OF THE RDS RADIO RECEIVER

- Name of the station.
- Alternative Frequency (AF).
- Current time display (CT).
- Station search basing on the program type (PTY).
- Digital signal level (range from 16 to 70 dBmV).
- FM: 87.5 - 108 MHz.
- AM: 522 - 1611 MHz.
- LW: 144 - 288 MHz.
- 30 presets.
- Direct tuning by introducing frequency.
- Automatic station search.
- Alphabetical Organization of the stations.
- System control based on menus.
- Display customization.

Recommended equipment:

Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x
Function Generator	GF-232, GF-941

Amplifier Training System



*The **EP-834** is the proper equipment to study the theoretical and practical aspects of the power amplifiers through the analysis of the signals involved in the different functional processes.*

The trainer **EP-834** is based on a high quality power amplifier, with the most advanced technology and design, using a hybrid power stage. It includes two resistive loads (8Ω - 300W) which allow simulating the connection of the speakers.

BLOCK DIAGRAMS

The block diagrams consist of the following functional modules, each with the test points for the most important signals involved in the operation:

- Input signal source.
- Input signal source control.
- System control.
- RIIA correction.
- Loudness filter.
- Subsonic filter.
- Tone control and physiological filter.
- Power section.
- Speakers protections.
- Power supply.

Each one of the functional sections have several test points which permit the analysis and monitoring of the main electrical signals of the amplifier.

FAULT SIMULATOR

The fault simulator manipulates electric points of the amplifier, allowing to simulate a large number of real faults, so that the teacher can evaluate the diagnostic process performed by the student and therefore the degree of assimilation of the basic concepts studied.

INCLUDED DOCUMENTATION (in CD-ROM)

- User's Manual.
- Training Manual.
- Teacher's Manual.
- Electric diagrams and Technical Documentation.

The following documentation is also included (in paper):

- Theory Manual.
- Power Amplifier User's Manual.

ACCESSORIES

- Loads 8 Ω - 300 W (2 units).
- Remote control.
- Batteries (2 units R6 AA).
- Headphones + Adapter.

POWER AMPLIFIER

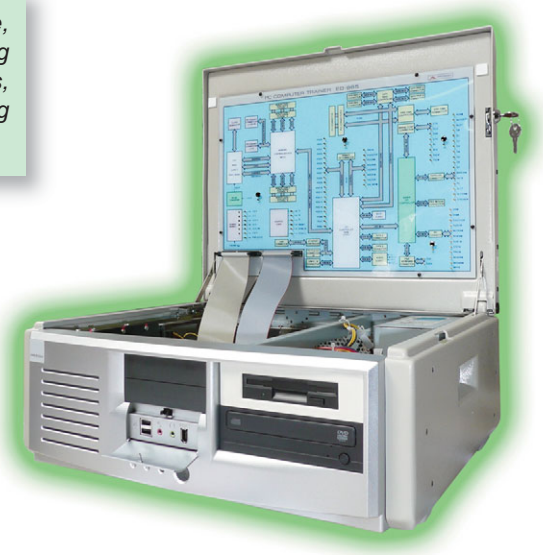
- Hybrid amplification.
- DIN power output (4Ω at 1 kHz): 70 W + 70 W.
- Protection against short circuits.
- Tone control: bass and treble.
- Loudness control.
- Balance adjustment.
- 6 audio inputs.
- Source Direct (to listen directly to the input signal).
- Tape monitor.
- Headphone output:
  - PHONO (20 Hz - 20 kHz): RIAA equalisation curve ± 1 dB.
  - TUNER, CD, AUX, TAPE1 / DAT, TAPE 2 / MD: 7 Hz - 70 kHz ± 0,3 dB.
- S/N ratio:
  - PHONO: 80 dB.
  - TUNER, CD, AUX, TAPE1 / DAT, TAPE 2 / MD: 105 dB.
- Impedance of the speakers: 4 - 16 Ω.

Recommended equipment:

Digital Oscilloscopes	OD-410, OD-460 / Series OD-57x, OD-59x
Function Generators	GF-232, GF-230, GF-941

Personal Computer Training System

*The **EO-865** offers to the educational centres an affordable, all-in-one, up-to-date, latest-generation instrument for learning the theoretical and practical aspects of personal computers, as well as understanding the aspects related to computing and information technology.*



The trainer includes a powerful latest-generation **multimedia PC**, **Intel® Core™ 2 Duo** processor, a **breakdown module** and an **active block diagram** which allows to analyse the main signals of the PC hardware, as well as its peripherals. The training system also includes a **15" Multimedia monitor**.

The PC, together with the failure simulator module and the block diagram, is housed in a box which can be locked by key and stacked, thereby making storage that much easier, and offers the possibility of using the training system as a conventional PC without fear of the interior having been interfered with.

The educational program based on EO-865 trainer covers the following aspects:

- Configuring a PC with corresponding peripherals.
- Installing and configuring the operating system.
- Verification and diagnostic of a PC[1].
- Operation of the PC Hardware architecture.
- Operating systems.
- Introduction and virus removal[2].
- Repair and maintenance.
- Advanced diagnostic[1].
- Multimedia and communications.

The diagnostic kit (**OP-865**), which is available as an option, contains the hardware and software necessary to:

- Evaluation of the PCI bus.
- Visualization of the self-check codes (POST).
- Disk controller diagnostic.
- Retrieving technical data from the system.
- Testing a floppy disk (read / write / search).
- Test of the basic and extended memory.
- BIOS Setup.
- Video verification.
- Checking serial and parallel ports.
- Low level format.

Consumer

Intel® BASED SYSTEM(*):

- Intel® Core™ Duo 2,2 GHz processor (or higher version).
- INTEL motherboard: 1 GB DDR2 (800 MHz).
- 3 PCI Express slots + 2 PCI slots.
- 8 USB 2.0 ports + 1 serial port + 1 parallel port.
- 8 Serial ATA channels.
- High Definition AC'97 audio system.
- PCI Express video card (64 MB).
- 500 GB SATA Hard Disk + 3½ 1,44 MB floppy+ DVD IDE x16.
- Internal 56,000 bps Modem/Fax.

MONITOR

- Multimedia 15" colour monitor.

ACCESSORIES:

- 1 Windows keyboard.
- 1 Mouse.

SOFTWARE:

- Microsoft Windows XP Home Edition operating system (**).
- Virus simulation software.

INCLUDED DOCUMENTATION (in CD-ROM):

- User's Manual.
- Teacher's Manual.
- Practice Manual.
- Technical Documentation Manual.
- Theory Manual (in paper format).

DIAGNOSTIC KIT OP-865 (OPTIONAL):

- Diagnostic and repair software EXPERTCHECK.
- POST codes module detector.
- Serial ports checking module.
- Parallel port checking module.

(*) System features are subject to hardware avaibilities, and are subject to changes without prior notice due to new developments or improvements made by their manufacturers.

1. Requires a Diagnostic Kit (optional)
2. Requires an Antivirus (not provided)

(**) Please check compatibility with other Operating Systems.

Recommended equipment:

Digital Oscilloscopes	OD-410, OD-460 / Series OD-570, OD-590

Application Programming and Development Trainer with Programmable Logic Devices

*The **TM-530** trainer is an innovative educational tool specifically created for easily learning the design, programming and development of applications using programmable logic devices (PLD). It may also be used professionally as an agile testing instrument for designing logic circuits without the need of creating connections or welding, or wasting time building circuits. The instrument consists of:*

- *Wiring configuration and programming software*
- *PLD application design, compilation and simulation software*
- *Hardware module + ISP devices (in system programmable)*
- *Documentation (CD-ROM)*

The configuration software enables PLD connections to be graphically assigned to the various components that make up the hardware module, without the need of the student to physically having to create the connections. The same software loads the application files (previously generated by the design software) onto the hardware module ISP device, "*in system programmable*".

Using the PLD application design, compilation and simulation software, the student enters the logic circuit design with diagrams or ABEL-HDL to generate the JEDEC file, which is then recorded in the PLD.

Operation of the design may be functionally simulated before recording.

The hardware module is then used by the student to test the real operation of the application. The hardware module includes two Lattice devices (ispGAL22V10 and ispLSI1024), null insertion socket for GAL devices and a wide range of inputs/outputs (micro-switches, buttons, clocks, LEDs, displays and A/D and D/A converters, etc.) assigned by the configuration software. It also has a parallel bus output.

SPECIFICATIONS

- Graphic User Interface.
- Programming GAL-type logic devices: 16V8, 20V8 and 22V10.
- Null insertion sockets for GAL's.
- Programming ispGAL22V10 and ispLSI1024 logic devices on boards.
- Flexible input/output software assignation of the logic device according to application.
- Output compatible with PROMAX series MM-6XX educational modules.
- Communication between the trainer/programmer and a PC using the parallel port.
- Included power supply.

AVAILABLE INPUTS/OUTPUTS

- 1, 8-bit D/A converter.
- 1, 8-channel, 8-bit A/D converter.
- 2, 7-segment displays.
- 2 relay outputs.
- 16 switches.
- 1 variable oscillator.
- 16 led diodes.
- 2 buttons.
- 1 hexadecimal keyboard.
- 1 application connector.

EXERCISES (EXTRACT)

- Basic gates: NOT, AND, OR, NAND, NOR, XOR, NXOR.
- Multiplexer/ Demultiplexer.
- Encoder/Decoder.
- Bit adder 4, 8, ...
- Comparator.
- Registries.
- Counter.
- Sequence detector.

INCLUDED DOCUMENTATION (in CD-ROM)

- User's Manual.
- Guided Exercise Manual.
- Teacher's Manual.

REQUIREMENTS

- PC-PENTIUM II® or greater.
- Windows 98® O.S.
- Parallel port.

Recommended equipment:

Digital Oscilloscopes	OD-410, OD-460 / Series OD-570, OD-590
Function Generator	GF-232, GF-230, GF-941

Industrial

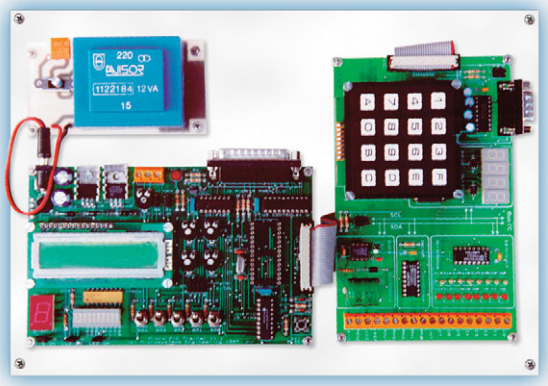
Micropic LAB plus Basic PICS Trainer (16F84 Family)

*The **MICROPIC LAB PLUS** is an instrument for use by professional and higher educational laboratories, as well as by PIC microcontroller design and engineering firms.*

The **IC-003** consists of:

- **MICROPIC TRAINER:** Development system.
- **MICROPICTRAINER PLUS:** Peripherals expansion card.
- **PICS I DESIGN COURSE:** PIC design practical course.

The whole thing is mounted on a methacrylate board for easy use, transport and storage.



The **MICROPIC LAB PLUS** allows for training on and the design of projects ranging from the simplest ideas to the most spectacular applications using a multitude of peripherals and advanced communications protocols such as RS-232 and I2C buses.

In industrial design tasks, the instrument provides all the hardware and software resources that are normally required for the development of any system. The device includes a practical design course employing PICs, which has been specifically created for those who are beginning microcontroller design, in mind. All the exercises are carried out using the **PIC16F84** and the **MICROPIC TRAINER** and **MICRO PIC TRAINER PLUS** tools, in combination with either the **SIMUPIC'84** or the **MPLAB** simulator.

MICROPIC TRAINER

- Diskette containing the control software and applications.
- In-circuit PIC recorder.
- PIC eraser with EPROM and FLASH memories.
- 4 MHz quartz-crystal oscillator and Reset button.
- Cable for connection to the PC parallel port.
- Peripherals to emulate applications: LCD screen, 7-segment display, potentiometers to simulate analogue inputs, switches and LED diode bar.
- PICBUS expansion connector to adapt to the other modules.
- User manual, with a full tutorial for assembly, set up and handling. Contains various training programs.
- Various types of adapters and complementary resources to meet the user's needs and the wide range of PIC models.

MICROPIC TRAINER PLUS

- Direct connection to the MICROPIC TRAINER with the included 26-line flat cable and the PICBUS connector.
- RS-232 communications channel with standard connector. If the employed PIC has USART installed, use lines RC6 and RC7, if it is controlled by the software, use RB4 and RB5.
- I2C interface controlled by lines RC3 and RC4 in PICs using an integrated module, and by lines RB6 and RB7 when controlled by the software.
- 4-digit display of 7 segments controlled by integrated circuit I2C, model SAA1064.
- Four AD conversion channels and one DA, supported by the PCF8591 device.
- 8-digital-line I/O port through I2C device PCF8574.
- Diode bars giving information on the state of the digital lines.
- Real time Clock/Calendar with PCF8583 I2C device powered by a rechargeable Ni/Cd battery that also holds 240 bytes of non-volatile RAM memory.

PICS I DESIGN COURSE

Contents index:

- **Subject 1**: Programming the PIC16F84 and its Architecture. Collection of exercises using Simupic'84 and/or MPLAB.
- **Subject 2**: Main Resources: Timer, Switches, I/O, etc. Collection of exercises using the MICROPIC TRAINER.
- **Subject 3**: New Peripherals and the I2C Bus. Collection of exercises using the MICROPIC and the MICROPIC TRAINER PLUS.
- **Annexes**: 7 Containing the communications programs and routines, I2C Modules C Programs, etc.
- **DISKETTE**: Contains the solutions to all the given exercises in Assembler and C languages.

(The Documentation is only available in Spanish language)

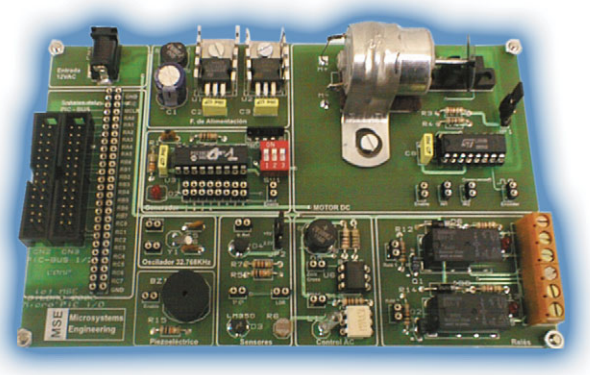
Industrial

Advanced PIC Trainer Extension (16F87x family)

*The expansion module **IC-004** of the basic PICs trainer **IC-003** is aimed at users with a knowledge of the basic principles involved in PIC design laid out in the first part and who now want to learn more about the new, powerful resources contained in the latest models of the PIC16F87x family. All the exercises in this part are carried out using the PIC16F873.*

There is a wide range of classic applications that are used in industry: motor governors, power control, analogue parameter manipulation, wave train generation, relay activation, etc. Certain specific resources are employed to support these requirements, therefore the microcontrollers involved in these processes are to be found in a chip.

The average range of PICs contains models with the particular devices needed to accomplish a specific industrial task already installed in the silicone chip. Special mention should be made of the PIC16F87X which includes AD converters, various timers, a UART series channel, an I2C bus, capture and comparison modules, pulse width modulation, etc.



The **IC-004** consists of:

- **MICROPIC IO**: Advanced peripherals card (sensors and industrial actuators).
- **F87x SOCKET**: Kit for performing exercises with **PIC 16F873**.
- **PIC II DESIGN COURSE**: Advanced PIC design practical course.

MICRO PIC IO

The **MICROPIC IO** card, connected directly to basic PIC trainer **IC-003**, makes an excellent test bed to analyse and debug the routines which control the peripherals and resources commonly used in industry.

In order to help the user get the most out of his MICROPIC IO card, an advanced PIC design practical course is included which contains various exercises, programs and projects, as well as a selection of industrial control routines that may be applied to the **MICRO PIC IO** modules.

These require the **MICROPIC TRAINER**, the ZOC87x adapter socket, the **MICROPIC TRAINER PLUS** and the **MICROPIC IO** card. The 9 subjects begin with a brief summary of each device and then propose a series of exercises to demonstrate its operation. Special emphasis is given to motor control, the control of analogue sensors using converters, wave generation, power control using triacs, relay activation, FLASH and EPROM program and data recording, etc.

MICROPIC IO

- DC motor speed control.
- Optical encoder to control motor rotation and speed.
- GMultiple wave generator.
- Power control using the Triac firing angle.
- Illumination control.
- Oscillator.
- Analogue light and temperature sensors.
- Two microrelays.
- Piezoelectronic buzzer.
- 12 VAC power supply.
- Stabilised power source.
- Two PICBUS connectors for adapting to other tools.
- User's Manual.

ZOC F87x SOCKET

This is a kit that allows you to control the latest **PIC16F87x** resources in the **MICROPIC TRAINER** using a FLASH memory. Furthermore the adapter socket also includes a **PIC16F873** with a recorded demonstration program, the latest version of the **PICME-TR** program and documentation.

COURSE FOR PICS DESIGN II

- **Subject 1**: Programming the **PIC16F87x** and its Architecture. Exercises with I/O ports.
- **Subject 2**: Timer 1. Exercises.
- **Subject 3**: Timer 2. Exercises.
- **Subject 4**: Capture and Comparison Module. Exercises.
- **Subject 5**: PWM Module. Exercises.
- **Subject 6**: The Analogue/Digital Converter. Exercises.
- **Subject 7**: The MSSP Series Port: UART Mode. Exercises.
- **Subject 8**: Serial Communications using the I2C Bus. Exercises.
- **Subject 9**: Programming and Handling the EPROM and FLASH. Exercises.
- **Annexes**.

Didactic panels for electrical installations

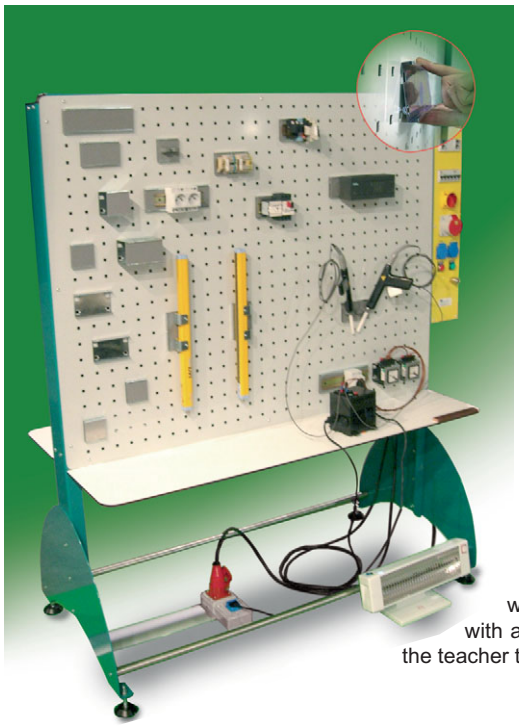
The installation panels are practical elements, specially designed to create an environment as versatile as possible to the most appropriate installation which the students can found in the daily life after completing their training.

These panels are particularly designed for workshops, colleges and general training centers, where the structure is easily adapted to the technology such as electronics, electricity, home automation, alternative energy, etc.

EASY INSTALLATION

The panels are ready for instant assembly without tools and without any kind of accessory modules. The different components are placed in the proper position for easy onward connections.

On each panel 60 modules of 70 x 70 mm can be assembled, or the equivalent surface can be filled with larger modules.



The panels include a protective device (electronic fuse), which can avoid short-circuits and over-currents. This protection is similar to the one offered by the electromechanical devices such as ICP or as the solid state relays.

The main difference between the built-in protective device and a conventional one is the high cutting speed. This speed allows focusing the short circuit in a single place, and therefore it does not affect the rest of the installation.

It also reduces significantly, and almost cancels, the blast produced by direct short circuit, and avoids the creation of the arc during the delay time of the trigger, protecting the contacts associated of the solid state relay. This feature extends the life of the electromagnetic component.

It also counts with electrically isolated remote control via optical couplers, which can detect the trigger of DISAPCE and rearm it from distance. It counts with audible acoustic alarm, which can be reactivated by button or key. This allows the teacher to control the assembly of the circuits.

OP-120-01

Kit of materials for electrical installations and lighting. The basic kit consists of the equipment necessary to perform the basic practices which can be found in a domestic electrical installation. It contains switches, normal cross-buttons switches, appliqués, primers, buzzers, motion detectors, automatic switches for stairs, etc. It includes an exercise manual.

OP-120-02

Kit of materials for automatic electrical installations. It includes the equipment necessary to perform the basic practices which can be found in an industrial installation. It contains buttons, selectors, pilots, relays, timers, limit switches, contactors, protective motors, motors, etc.. It includes an exercise manual.

LEADING THE EUROPEAN MARKET IN DESIGN AND MANUFACTURE OF TEST&MEASUREMENT EQUIPMENT

TEST AND MEASUREMENT

* DIGITAL AND ANALOGUE OSCILLOSCOPES
* SIGNAL GENERATORS
* FREQUENCY COUNTERS
* COMPONENTS TESTERS
* POWER SUPPLIES FOR LAB USE
* DIGITAL MULTIMETERS
* GPIB PROGRAMMABLE INSTRUMENTS

ANALOGUE AND DIGITAL FIELD STRENGTH METERS FOR DTT / SAT / CATV

* TV AND SATELLITE LEVEL METERS
* DIGITAL AND ANALOGUE SIGNAL METERS
* SPECTRUM MONITORS
* CATV ANALYSERS: TV + INTERNET + VoIP

INSTRUMENTS FOR TV&AUDIO TESTING

* TV SIGNAL GENERATORS: CRT, TFT & PLASMA
* TS (TRANSPORT STREAM) AND DTT (DIGITAL TERRESTRIAL TELEVISION) GENERATORS
* MONITOR TEST GENERATORS
* EQUIPMENT FOR REPAIR SERVICE CENTERS

DTTV DIGITAL TO TV - TV DISTRIBUTION SYSTEM

* DVB-S AND DVB-S2 RECEIVERS
* COFDM MODULATORS
* QPSK-COFDM TRANSMODULATORS
* A/V-COFDM MULTIPLEXERS
* COMBINERS
* AMPLIFIERS

BROADCAST

* BROADCAST MONITORING
* DVB-T AND DVB-H MONITORING
* TRANSPORT STREAM RECORDERS AND PLAYERS

RF EQUIPMENT

* SPECTRUM ANALYSERS
* RF GENERATORS
* WATTMETERS
* RF IMPEDANCE LOADS
* WI-FI ANALYSERS

DIGITAL DEVICES TESTING EQUIPMENT

* LOGIC ANALYSERS
* PLDs PROGRAMMER
* EPROM ERASERS

OPTICAL FIBRE INSTRUMENTS

* GPON METER FOR FTTH
* MICRO OTDR WITH LCD COLOR SCREEN
* PORTABLE OPTICAL SPECTRUM ANALYSERS
* LIGHT SOURCES: LED AND LASER
* POWER METERS
* OPTICAL FIBRE IDENTIFIER
* FAULT LOCATOR

CABLE TESTERS

* LAN AND TELEPHONE CABLE TRACER
* LAN NETWORKS TESTERS
* LAN NETWORKS CERTIFIERS
* TELEPHONY NETWORKS TESTERS
* DOMOTICS AND CCTV ANALYSERS

ELECTRICAL MEASUREMENT EQUIPMENT

* ELECTRICAL NETWORKS ANALYSERS
* CURRENT AND WATTMETER CLAMPS
* EARTH AND INSULATION METERS
* RCD TESTERS
* SOUND LEVEL AND IMPEDANCE METERS
* LUX METERS AND TACHOMETERS

EDUCATIONAL TRAINERS

* UNIVERSAL DIGITAL TV RECEIVER TRAINERS
* TRAINING SYSTEMS FOR MDUS INFRAESTRUCTURES
* FLAT SCREEN LCD / PLASMA TV TRAINERS
* MICROPROCESSOR AND PLDs TRAINERS
* ANALOGUE AND DIGITAL COMMUNICATIONS TRAINING SYSTEMS
* FIBRE OPTICS TRAINERS
* CONSUMER ELECTRONICS TRAINING SYSTEMS, TV AND VIDEO, AUDIO
* TELEPHONY TRAINERS

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AE-966/967

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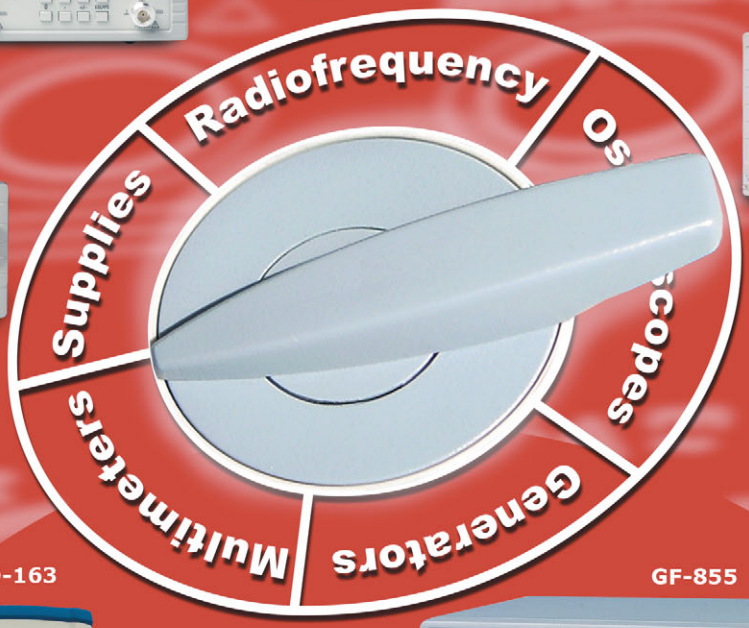
FA-405



Handheld oscilloscopes

OS-782

PD-185

PD-163

PD-161

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GF-855

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GF-857

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